

WHAT IS CLAIMED IS:

1. A substrate holding apparatus for holding a substrate and bringing it into contact with a polishing surface so that the substrate is subjected to polishing by causing relative movement between the substrate and the polishing surface, said apparatus comprising:

    a substrate holder body having a substrate holding side facing the polishing surface and holding a substrate on said substrate holding side; and

    a retainer ring integrally formed with or fixedly secured to said substrate holder body on said substrate holding side, the retainer ring being arranged to surround an outer periphery of the substrate held by said substrate holder body so that the retainer ring engages with the polishing surface radially outside said substrate as the polishing of the substrate is effected;

    said substrate holder body being provided on said substrate holding side with a membrane having opposite surfaces including inside and outside surfaces, the inside surface cooperating with a surface of said substrate holder body to define a fluid pressure chamber to which a fluid pressure is applied, the outer surface engaging with the substrate held by said substrate holder body.

2. A substrate holding apparatus as set forth in claim 1, wherein said substrate holder body is in the shape of a dish having a disc-like member and a peripheral ring member provided on an outer periphery of the disc-like member on said substrate holding side; said retainer ring is integrally formed with or fixedly secured to said peripheral ring member; said disc-like member, said peripheral ring member and said retainer ring cooperate to define an inner space; and, said membrane is provided in said inner space.

3. A substrate holding apparatus as set forth in claim 2, wherein said substrate holding apparatus further comprises a membrane support member which is provided in said inner space and connected to the outer periphery of said membrane and a flexible annular seal member connected between said

membrane support member and said peripheral ring member so that said fluid pressure chamber is defined by said membrane, said membrane support member, said flexible annular seal member and said substrate holder body.

4. A substrate holding apparatus as set forth in claim 3, wherein said membrane is provided with one or more through holes extending between said inner and outer surfaces thereof.

5. A substrate holding apparatus as set forth in claim 3, wherein said apparatus further comprises a chucking plate positioned inside and connected to said membrane support member; and said chucking plate has opposite surfaces including inner surface and outer surface which is adjacent to said inner surface of said membrane and one or more through holes extending between said opposite surfaces thereof.

6. A substrate holding apparatus as set forth in claim 5, wherein said outer surface of said chucking plate is provided with one or more recesses fluidly connected to said through holes.

7. A substrate holding apparatus as set forth in claim 5, wherein said outer surface of said chucking plate has one or more raised or elevated portions each having a flat surface; said through hole opens at the flat surface; and said membrane is provided with one or more openings through which said elevated portions of said chucking plate are exposed to a substrate held on said outer surface of said membrane.

8. A substrate holding apparatus as set forth in claim 1, wherein said fluid pressure chamber is adapted to be selectively connected to a pressurized fluid source or a vacuum source.

9. A substrate holding apparatus as set forth in claim 1, wherein said retainer ring has an annular face having radially inner and outer edges and to be engaged with the polishing surface; and said annular face is provided with one or more grooves extending from said radially outer edge towards said radially inner edge.

10. A substrate holding apparatus as set forth in claim 9, wherein said grooves reach said radially inner edge.

11. A substrate holding apparatus as set forth in claim 9, wherein said grooves end short of said radially inner edge.

12. A substrate holding apparatus as set forth in claim 7, wherein said apparatus further comprises a conduit connecting said through holes of said chucking plate to a vacuum source and a conduit connecting said fluid pressure chamber to a pressurized fluid source.

13. A substrate holding apparatus as set forth in claim 3, further comprising one or more pushers provided on said substrate holder body and arranged to engage with and urge said membrane support member towards the polishing surface.

14. A substrate holding apparatus for holding a substrate and bringing it into contact with a polishing surface so that the substrate is subjected to polishing by causing relative movement between the substrate and the polishing surface, said apparatus comprising:

a substrate holder body having a substrate holding side facing the polishing surface and holding a substrate on said substrate holding side;

a retainer ring integrally formed with or fixedly secured to said substrate holder body on said substrate holding side thereby forming an inner space defined by said substrate holder body and the retainer ring, the retainer ring being arranged to surround an outer periphery of the substrate held by said substrate holding apparatus so that the retainer ring engages with the polishing surface radially outside said substrate as the polishing of the substrate is effected;

a substrate support ring provided in said inner space and arranged to be sealingly engaged with the substrate to be held by said substrate holding apparatus, and

a flexible seal member sealingly connected between said substrate support ring and said substrate holder body so that a fluid pressure chamber is defined by said substrate holder body, said flexible seal member and the substrate engaged with said substrate support ring, said

fluid pressure chamber being arranged to be selectively connected to a pressurized fluid source or a vacuum source.

15. A substrate holding apparatus as set forth in claim 14, further comprising one or more pushers provided on said substrate holder body and arranged to engage with and urge said substrate support ring towards the polishing surface.

16. A substrate polishing apparatus comprising:

a first polishing table having a hard polishing surface; and

a substrate holding apparatus for holding a substrate and bringing it into contact with said hard polishing surface, the substrate being subjected to polishing by causing relative movement between the substrate and the polishing surface;

said substrate holding apparatus comprising:

a substrate holder body having a substrate holding side facing the polishing surface and holding a substrate on said substrate holding side; and

a membrane provided on said substrate holding side of said substrate holder body, said membrane having opposite surfaces including inside and outside surfaces, the inside surface cooperating with a surface of said substrate holder body to define a fluid pressure chamber to which a fluid pressure is applied, the outer surface engaging with the substrate held by said substrate holder body.

17. A substrate polishing apparatus as set forth in claim 15, wherein said hard polishing surface has a modulus of compression of 19.6 MPa (200kg/cm<sup>2</sup>) or more.

18. A substrate polishing apparatus as set forth in claim 15, wherein said hard polishing table is provided with fixed abrasives comprising abrasive particles and a binder binding said abrasive particles and the fixed abrasives provides said hard polishing surface.

19. A substrate polishing apparatus as set forth in claim 15, wherein said substrate holding apparatus further comprises a retainer ring integrally formed with or fixedly secured to said substrate holder body on said substrate holding side, the retainer ring being arranged to surround

an outer periphery of the substrate held by said substrate holder body so that the retainer ring engages with the hard polishing surface radially outside said substrate as the polishing of the substrate is effected.

20. A substrate polishing apparatus as set forth in claim 15, said apparatus further includes a second polishing table having a soft polishing surface which is softer than said hard polishing of said first polishing table and said substrate holder body is arranged such that the substrate holder body holds a substrate and, then, bring the substrate into contact with said hard polishing surface to effect a first polishing of the substrate and, thereafter, bring the substrate into contact with said soft polishing surface to effect a second polishing of the substrate.

21. A substrate polishing apparatus as set forth in claim 20, wherein said soft polishing surface has less modulus of compression than said hard polishing surface.

22. A substrate holding apparatus as set forth in claim 15, wherein said retainer ring has an annular face having radially inner and outer edges and to be engaged with the polishing surface; and said annular surface is provided with one or more grooves extending from said radially outer edge towards said radially inner edge.

23. A substrate holding apparatus as set forth in claim 22, wherein said grooves reach said radially inner edge.

24. A substrate holding apparatus as set forth in claim 22, wherein said grooves end short of said radially inner edge.

25. A substrate polishing apparatus comprising:  
a first polishing table having a hard polishing surface; and

a substrate holding apparatus for holding a substrate and bringing it into contact with said hard polishing surface, the substrate being subjected to polishing by causing relative movement between the substrate and the polishing surface;

said substrate holding apparatus comprising:  
a substrate holder body having a substrate holding

side facing the polishing surface and holding a substrate on said substrate holding side; and

a substrate support member provided on said substrate holding side of said substrate holder body and arranged to be sealingly engaged with the substrate to be held by said substrate holding apparatus, and

a flexible seal member sealingly connected between said substrate support ring and said substrate holder member so that a fluid pressure chamber is defined by said substrate holder body, said flexible seal member and the substrate engaged with said substrate support member, said fluid pressure chamber being arranged to be selectively connected to a pressurized fluid source or a vacuum source.

26. A substrate polishing apparatus as set forth in claim 25, wherein said hard polishing surface has a modulus of compression of 19.6 MPa (200kg/cm<sup>2</sup>) or more.

27. A substrate polishing apparatus as set forth in claim 25, wherein said hard polishing table is provided with fixed abrasives comprising abrasive particles and a binder binding said abrasive particles and the fixed abrasives provides said hard polishing surface.

28. A substrate polishing apparatus as set forth in claim 25, wherein said substrate holding apparatus further comprises a retainer ring integrally formed with or fixedly secured to said substrate holder body on said substrate holding side, the retainer ring being arranged to surround an outer periphery of the substrate held by said substrate holder body so that the retainer ring engages with the hard polishing surface radially outside said substrate as the polishing of the substrate is effected.

29. A substrate polishing apparatus as set forth in claim 25, said apparatus further includes a second polishing table having a soft polishing surface which is softer than said hard polishing of said first polishing table; and, said substrate holder body is arranged such that the substrate holder body holds a substrate and, then, bring the substrate into contact with said hard polishing surface to effect a first polishing of the substrate and,

thereafter, bring the substrate into contact with said soft polishing surface to effect a second polishing of the substrate.

30. A substrate holding apparatus as set forth in claim 25, wherein said retainer ring has an annular face having radially inner and outer edges and to be engaged with the polishing surface; and said annular surface is provided with one or more grooves extending from said radially outer edge towards said radially inner edge.

31. A substrate holding apparatus as set forth in claim 30, wherein said grooves reach said radially inner edge.

32. A substrate holding apparatus as set forth in claim 30, wherein said grooves end short of said radially inner edge.

33. A substrate holding apparatus for holding a substrate during a polishing operation of the substrate, said substrate holding apparatus comprising:

a substrate holder body;

a retainer ring integrally formed with or fixedly secured to said substrate holder body; and

a flexible membrane having inner and outer surface and arranged inside the retainer ring in such a manner that the inner surface cooperating with the substrate holder body to define a fluid chamber therebetween, the outer surface providing a substrate holding surface for holding the substrate;

wherein the substrate held by the substrate holding surface is urged against a polishing surface by a fluid pressure supplied into the fluid chamber.

34. A substrate holding apparatus as set forth in claim 33, further comprising a drive shaft connected to the substrate holder body for rotating the substrate holder body while the substrate being kept urged against the polishing surface, the drive shaft being operable to urge the retainer ring against the polishing surface through the substrate holder body.

35. A substrate holding apparatus as set forth in claim 33, further comprising an air cylinder for applying a force

to urge the retainer ring against the polishing surface through the substrate holder body.

36. A substrate holding apparatus for holding a substrate during a polishing operation of the substrate, said substrate holding apparatus comprising:

a substrate holder body holding a substrate; and a retainer ring provided on an outer periphery of the substrate holder body so that the substrate held by the substrate holder body is positioned radially inside the retaining ring, the retainer ring having an annular surface to be engaged with a polishing surface radially outside the substrate when the substrate is brought into contact with the polishing surface for polishing of the substrate, the annular surface having radially outer and inner peripheral edges and a groove extending from the radially outer peripheral edge towards the radially inner peripheral edge.

37. A substrate holding apparatus as set forth in claim 36, in which the groove ends short of the radially outer peripheral edge.